CLAIMS

I claim:

1. A four-port loop optical circulator comprising:

a first, a second, a third and a fourth optical ports for receiving optical beam therein; and

a plurality of optical components for guiding a beam received from said first port to project from said second port, for guiding a beam received from said second port to project from said third port, for guiding a beam received from said third port to project from said fourth port, and for guiding a beam received from said fourth port to project from said first port.

2. The four-port loop optical circulator of claim 1 wherein:

said plurality of optical components further includes a walk-off crystal for generating a vertical optical path displacement for a vertical polarized optical beam and for passing a horizontally polarized optical beam therethrough maintaining a same optical path.

3. The four-port loop optical circulator of claim 2 wherein:

said plurality of optical components further includes a first birefringent crystal disposed on a left hand-side of said walk-off crystal for generating a first ordinary beam and a first extra-ordinary beam and a second birefringent crystal disposed on a right-hand side of said walk-off crystal for generating a second ordinary beam and a second extra-ordinary beam.

4. The four-port loop optical circulator of claim 2 wherein:

said plurality of optical components further includes a first polarization rotation means disposed on said left hand-side of said walk-off crystal for generating a first state of polarization (SOP) for said first ordinary beam and said first extra-ordinary beam to project to said walk-off crystal and a second polarization rotation means disposed on said right-hand side of said walk-off crystal for generating a second SOP for said second ordinary beam and said second extra-ordinary beam to project to said walk-off crystal wherein said first SOP is orthogonal to said second SOP.

5. The four-port loop optical circulator of claim 2 wherein:

said plurality of optical components further includes a vertical displacement means for shifting an optical path along a vertical direction with a predefined vertical displacement for an optical beam transmitted with a particular polarization.

6. The four-port loop optical circulator of claim 5 wherein:

said vertical displacement means further comprising a polarized beam splitter for reflecting an optical beam with said particular polarization substantially along a vertical direction for generating said predefined vertical displacement.

7. The four-port loop optical circulator of claim 7 wherein:

said vertical displacement means further comprising a right angle prism disposed at said predefined vertical displacement away from said polarized beam splitter, said right angle prism reflecting said optical beam with said particular polarization projected from said polarized beam splitter for transmitting said optical beam with said particular polarization substantially along a horizontal direction.

8. The four-port loop optical circulator of claim 7 wherein:

said vertical displacement means further comprising a first set of half wave plates for changing a state of polarization (SOP) of a beam by 90 degrees toward a first angular direction to a PBS-incident SOP to allow a beam to pass through or reflected from said PBS depending on said PBS-incident SOP then another set of half wave plates to rotate said SOP of said beam by 90 degrees toward a second angular direction opposite to said first angular direction.

9. A switchable optical loop circulator comprising:

a loop optical circulator and at least an optical switching means disposed in an optical path of the loop circulator for switching optical transmission paths of said loop optical circulator.

10. The switching means of claim 9 wherein:

said switching means comprising a set of latched Faraday rotators surrounded by an electromagnetic pulse means for controlling a rotation direction of said latched Faraday rotators.

11. The switching means of claim 9 wherein:

said switching means further comprising electrically controlled half wave plates composed of electro-optic materials.

12. The switching means of claim 9 wherein:

said switching means further comprising an electrically controlled half wave plate composed of liquid crystals

13. The switching means of claim 9 wherein

said switching means further comprising an electrically controlled in/out rhomb prism.

14. The switching means of claim 9 wherein

said switching means further comprising an electrically controlled in/out DOVE prism